Transportation Synthesis Report

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Slurry Backfills in Approach Embankments

Prepared for
Wisconsin Highway Research Program
Technical Oversight Committee on Geotechnics

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Transportation Synthesis Reports are brief summaries of currently available information on topics of interest to WisDOT technical staff. Online and print sources for TSRs include NCHRP and other TRB programs, AASHTO, the research and practices of other transportation agencies, and related academic and industry research. Internet hyperlinks in TSRs are active at the time of publication, but changes on the host server can make them obsolete.

Request for Report

The Wisconsin Highway Research Program's Technical Oversight Committee on Geotechnics requested a rapid-view synthesis report from Research and Communications Services on slurry backfills used in approach embankments of bridge abutments. Slurry, controlled low-strength materials, high volume waste materials and other materials have been used to fend off approach slab settlement, the cause of bumps that many road users experience at the end of bridges. The TOC seeks current research and state transportation agency practices in using such materials to combat settlement.

Summary

Efforts to address approach settlement through the use of select backfill materials have not, as yet, generated a great deal of research. Controlled Low-Strength Materials, or Flowable Fill, seems to be garnering research attention at this time, with a handful of recent and ongoing studies. Waste Foundry sand, a high-volume waste material, also enjoys ongoing attention through an Indiana installation under long-term monitoring. In addition to research in progress, we also found that NCHRP has a project panel devoted to CLSM in backfill.

State and National Studies

The following completed studies can be viewed online.

Kansas. Use of Controlled Low-Strength Material as Abutment Backfill.
http://www.ksdot.org/idmws/DocContent.dll?Library=PublicDocs^dt00mx38&ID=003689736&Page=1.
Using finite element analysis modeling and testing, researchers produced predictions of fluid pressure for various CLSM-wall configurations, and found settlement within the fill will be minimal. Various design recommendations were included.

Kentucky. Movements and Settlements of Highway Bridge Approaches.
http://www.ktc.uky.edu/Reports/KTC_02_18_SPR_220_00_1F.pdf.
Focused on bridge approach settlement, researchers in this study reviews current practices around the country as well as within specific transportation districts of Kentucky. Materials considered include slurry, flowable backfill, and more.

NCHRP. Guideline and Recommended Standard for Geofoam Applications in Highway Embankments.
http://trb.org/publications/nchrp/nchrp_rpt_529.pdf.
Included in this study is discussion of a geofoam bridge approach system, in which geofoam blocks are used in soft soil conditions.

Research in Progress

The following current studies will conclude in the next 19 months.

Indiana. Performance Evaluation of a Highway Embankment Constructed Using Foundry Sand. http://rip.trb.org/browse/dproject.asp?n=1986. This ongoing project monitors geotechnical and environmental aspects of a waste foundry sand highway embankment in Indiana. The work seeks to monitor performance of a field demonstration with a view toward assessing viability in highway construction practice. This study is the field implementation of a preparatory study that was concluded in 1999. For the abstract on the earlier phase, see http://rip.trb.org/browse/dproject.asp?n=1985.

NCHRP Project 24-12(01). Controlled Low-Strength Material For Backfill, Utility Bedding, Void Fill, and Bridge Approaches. http://www4.trb.org/trb/crp.nsf/All+Projects/NCHRP+24-12(01).
This six-year study, expected to conclude in March of 2006, seeks to comprehensively analyze and define CLSM uses. It will define properties in various fill applications including bridge approaches, identify test methods and criteria for use of CLSM, examine and clarify relationships between CLSM properties and constituents, identify in-place monitoring methods, and finally develop design criteria and construction guidelines for its use. It is based on Phase I investigation by the Delaware Transportation Institute.

Colorado. Investigation of CDOT's Flowfill Specifications. http://rip.trb.org/browse/dproject.asp?n=11358. This study, expected to conclude in October of 2007, will review and improve Colorado DOT specifications and quality assurance procedures for flowfill from a performance-based perspective.

TRB Annual Meeting CD-ROM Papers.

The following papers can be viewed on TRB Annual Meeting Compendium of Papers CD-ROMs, available through the WisDOT library.

2006 CD-ROM. Numerical Simulation of Dynamic Behavior of Geofoam Embankment (06-0082).
For abstract, see http://trb.org/am/ip/paper_detail.asp?paperid=9350. Through modeling, researchers compare dynamic responses of an all-soil embankment with that of an all-geofoam embankment and another of geofoam with a soil veneer. Surface shaking, liquefaction, and inter-block slippage were considered, and use of geofoam was endorsed with caution in seismically sensitive settings.

2004 CD-ROM. Lateral Pressures on Bridge Abutments from Controlled Low-Strength Material (04-3777).
For abstract, see http://trb.org/am/ip/paper_detail.asp?paperid=1518. Researchers conclude that CLSM can "virtually eliminate settlement" behind bridge abutments. Laboratory tests and finite element analyses evaluated lateral pressures and predicted levels of full fluid pressure on the abutment.

NCHRP Project Panel

The following project panel page lists contacts on the panel and contact information.

D2412. NCHRP Project Panel on Controlled Low-Strength Material for Backfill, Utility Bedding, and Void Fill. See TRB page at http://trb.org/Directory/comm_detail.asp?id=2371.